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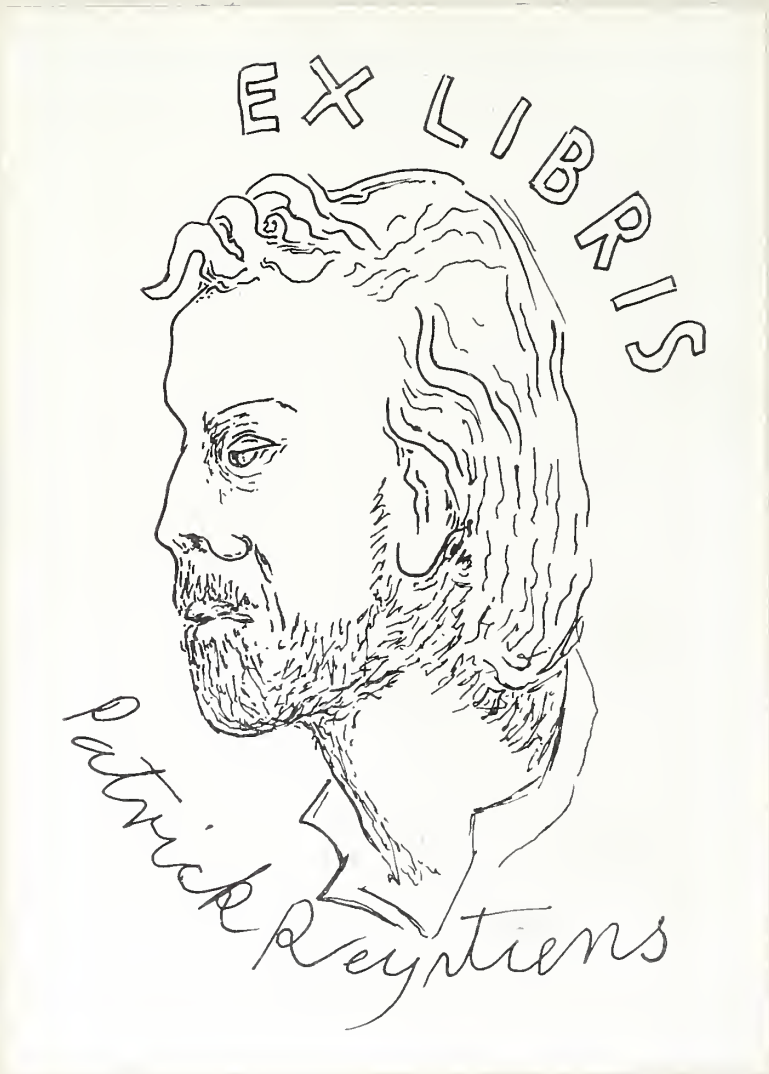

Potting, Enamelling, and Glass Staining.

THE VALUABLE

RECEIPTS

OF

THE LATE MR. THOMAS LAKIN,

WITH

PROPER AND NECESSARY DIRECTIONS

FOR

THEIR PREPARATION AND USE

IN THE

MANUFACTURE OF PORCELAIN EARTHENWARE,

AND

Iron Stone China,

TOGETHER

WITH THE MOST RECENT AND VALUABLE IMPROVEMENTS

IN THE ADMIRED ART OF

GLASS STAINING AND PAINTING.

LEEDS:

PRINTED FOR MRS. LAKIN, BY EDWARD BAINES.

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PREFACE.

THE progressive improvements in the manufacture of Porcelain and Earthenware, during the last thirty years, have raised this art to an eminence which it never reached before in the British Empire; and, perhaps, in no department of art has scientific research and experiment been so productive of wealth and fame as in this, and it is no undue encomium on the industry of the manufacturer to state, that the consumption at home, and the demands from abroad have kept pace with the improvements which have increased both.

The important station which this art holds amongst our manufactures, renders every attempt at improvement worthy of consideration and attention. It has been said, the man who causes one ear of corn to grow where one never grew before, deserves the thanks of his country; but what does that man merit who, by indefatigable industry, contributes materially to the advancement of the interests of his country, in the improvement of its manufactures; it was in this class, that the late MR. THOMAS LAKIN held a situation

much above mediocrity, for, in Staffordshire, it is well known that few men have contributed more to the improvement of an art so useful and so much admired.

The following work is the result of upwards of thirty years of labour, study, and repeated experiment, and no pains have been spared in arranging the various Receipts in such a chain of connexion as to render them easy of comprehension to an intelligent operator.

The Subscribers may rest assured, that the whole of the following Receipts may be individually depended upon as genuine, each having been repeatedly tried in the course of the Author's long experience. Mr. Lakin had also extensive practice in the admired art of Staining and Painting Glass; several windows of exquisite workmanship were executed by him during the time he was egaged with John Davenport, Esq, for some of the first noblemen in the kingdom. The Receipts, together with the method of using them, are therefore laid down from actual experiment, and it is hoped will be found extremely valuable.

In presenting the following work to the Subscribers, Mrs. Lakin is anxious to express her gratitude for the liberal encouragement she has met with, and for the highly gratifying tribute they have paid to the abilities of her departed husband; but to the kindness of those gentlemen who had before

purchased some of the Receipts at a price far beyond the whole charge of this work, and yet have become subscribers, she feels herself particularly indebted.

Mrs. L. respectfully solicits of the Subscribers not to permit persons who are not purchasers to copy any of the Receipts, as it might not only injure her as proprietor of the copy-right, but also other subscribers; on her part she pledges herself not to publish the work, nor permit the work to be published, at a lower price than that at which it is now offered to the Subscribers. viz £5. 5. 0

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A GENERAL SYSTEM

OF

POTTING, ENAMELLING, GLASS STAINING,

And Painting.

SECTION I.

RECEIPTS for superior and common Bodies of Porcelain, Earthenware, Vitreous, and Porous Bodies, together with various Coloured Drabs.

PROCESS 1.

To make a superior Porcelain Body.

Take 360 Parts of Bones.
230 - - of Cornish Clay.
50 - - of Cornish Stone.
20 - - of Flint.
20 - - of Blue or Brown Clay.
10 - - of Frit. See Process 30.
$\frac{1}{2}$ - - of Blue Calx.

PROCESS 2.

To make a superior Porcelain Body.

Take 400 Parts of Bones.
360 - - of Cornish Clay.
250 - - of Cornish Stone.
20 - - of Flint.
$\frac{1}{3}$ - - of Blue Calx.

In the bones used for the purpose of making China Bodies, every attention should be paid, that no decayed ones are made use of. The bones of animals owe their great firmness and solidity, to a considerable portion of phosphoric salt of lime which they contain; when broken into small pieces and boiled in water, they afford gelatinous matter, with a portion of fat oil; but by destructive distillation, they produce much volatile alkali. Bones are inflammable by virtue of their oil, and emit an offensive empyreumated smell; the white friable residue consists chiefly of lime in combination with phosphoric acid.

The qualities of China clays differ very much, being always mixed with particles of talc and mica. Mr. Wedgewood, in analizing, found them to contain 60 per cent. of argil, and 20 of silex; consequently, they are infusible at the most intense heat. These clays are of a yellowish white colour, smooth and greasy to the touch; with regard to the other materials used in the manufacturing of Porcelain, proper care and

attention should be strictly observed, that the purest kinds be made use of, otherwise it is probable the attainment of the object that the operator has in view, will be completely frustrated; it will be found on examination, or by experiment, that materials differ considerably as to quality. These porcelain bodies fire at a higher temperature than those generally manufactured in this country, and commonly are placed and fixed with ground flint previously calcined; being thus bedded in flint, each piece will retain its proper and regular shape. The mixture after being well dissolved in the water, is called slip, and is then sifted of a thickish consistence through the finest silk lawn, till it acquires the requisite degree of fineness; if sifted too thin, it will contain too much water, and the imperfect parts of the materials will be found to have passed through the lawn; under such circumstances, the slip will be much reduced in its specific gravity, consequently the body will be found inferior; and as china may be justly considered the master-piece of the potter's art, it will be highly essential to examine the materials of which the clay is made, in order that it may be brought to the highest state of perfection of which it is capable.

PROCESS 3.

To make an Iron Stone Body.

Take 300 Parts of Cornish Stone.
250 - - of Cornish Clay.
200 - - of Blue or Brown Clay.
100 - - of Flint.
1 - - of Blue Calx.

PROCESS 4.

To make an Iron Stone Body.

Take 175 Parts of Cornish Stone.
150 - - of Cornish Clay.
90 - - of Blue or Brown Clay.
35 - - of Flint.
5 - - of Frit, see Process 30.
$\frac{1}{2}$ - - of Blue Calx.

These Bodies are very ductile, and fire at the temperature of the common biscuit oven; each piece of ware should be perfectly dry when placed in the Seggars, because they are made a great deal thicker than any other kind. Setters also should be used at the bottom of each piece, and ground flint applied, but not sand, for the placing or seating; the Body, when burnt, is quite vitrified, and the pieces of ware strong and heavy, ringing remarkably shrill.

PROCESS 5.

To make a superior Printed Earthenware Body.

Take 3 Parts of Blue Clay.
1 - - of Black or Brown Clay.
2 - of Cornish Clay.
1¼ - - of Flint.
¼ - - of Cornish Stone.

PROCESS 6.

To make a Common Printed Earthenware Body.

Take 2 Parts of Blue Clay.
2 - - of Brown or Black Clay.
1 - - of Cornish Clay.
1¼ - - of Flint.

PROCESS 7.

To make a Superior Cream Coloured Body.

Take 1½ Parts of Blue Clay.
1½ - - of Brown Clay.
1 - - of Black Clay.
1 - - of Cornish Clay.
1 - - of Flint.
¼ - - of Cornish Stone.

PROCESS 8.

To make a Common Cream Coloured Body.

Take 1½ Parts of Blue Clay.
1½ - - of Brown Clay.
1½ - - of Black Clay.
1 - - of Flint.

In superior and common Bodies of printed and cream colour, the mode of preparation is the following:—The common clays are distinguished by colour and name; the Blue, Black, and Brown are most generally used; these are put into a large vessel of water, called the soaking tub or pot, and after being well stirred about, the clays quickly dissolve, and the water becomes of the consistence of slip, which is then passed through the finest silk lawn into another vessel, with proper gages fixed therein, so that the other materials may be correctly added afterwards in a slop state; the clay slip weighing per gallon 13½ lbs. Cornish Clay 13½ lbs. Cornish Stone 16½ lbs. Flint 16¼ lbs. and the passing through the lawns repeated again, as often as needful, so that the mixture may be deprived of all impurities. It is, perhaps, almost unnecessary to observe again, that it behoves every manufacturer to be very particular in ascertaining the quality of the different materials previous to using; some clays holding so much iron in solution as constitute them little better than marl, others are impregnated with pyrites in such proportion that when burnt exhibit abundance of metallic specks.

PROCESS 9.

To make a fine Lilac Porcelain Body.

Take 200 Parts of Bones.
115 - - of Cornish Clay.
25 - - of Blue Clay.
20 - - of Flint.
15 - - of Cauk Stone.
10 - - of Cornish Stone.
1¼ - - of Blue Calx.

This process requires a fire of the same temperature as the Porcelain Bodies, and must be treated in every respect exactly the same in manufacturing, &c.: *vide*, the manner described in Processes 1 and 2.

PROCESS 10.

To make a Superior Drab Body.

Take 24 Parts of Argillaceous Marl.
48 - - of Cornish Stone.
24 - - of Blue Clay.
10 - - of Bones.
1 - - of Nickle (Calcined.)

PROCESS 11.

To make a Common Brown, or Cottage Body.

Take 20 Parts of Red or Brown Clay.
8 - - of Cornish Clay.
4 - - of Blue Clay.
2 - - of Flint.

PROCESS 12.

To make a Fawn, or Drab Body.

Take 40 Parts of Marl.
4 - - of Cornish Clay.
1 - - of Flint.

PROCESS 13.

To make a Calcedony Body.

Take 32 Parts of yellow Clay.
10 - - of Cornish Clay.
4 - - of Flint.

PROCESS 14.

To make a Brown Body.

Take 50 Parts of Red Clay.
$7\frac{1}{2}$ - - of Common Clay.
1 - - of Manganese.
1 - - of Flint.

Of the Coloured Bodies, in Processes 10, 11, 12, 13, 14, the marls and clays should be selected of the finest quality that can be procured; marls are of a loose friable texture, easily reducible to powder, most readily separating and diffusing in water; when dug out of the earth they are pretty hard, but being exposed to the air soon fall to dust. There are several sorts of marls, of various colours and qualities, denominated by different appellations; the argillaceous marl will be found the best. The finest of lawns will be required if it is intended that the body should be clean and free from matallic spots.

PROCESS 15.

To make a Jasper Body.

Take 10 Parts of Cauk Stone.
10 - - of Blue Clay.
5 - - of Bones.
2 - - of Flint.
$1\frac{1}{4}$ - - of Blue Calx.

In preparing this body all the materials should be ground together, as much depends on the different articles being well united, which adds greatly to its fineness in colour and lustre. It fires at the temperature of earthenware ovens.

PROCESS 16.

To make a Superior White Body.

Take 50 Parts of Cauk Stone.
50 - - of Blue Clay.
25 - - of Bones.
10 - - of Flint.

No. 16 will be found of the same consistency, and requires the same temperature, as Process 15. It is perfectly adapted also for the purpose of figures in baso-relievo, and other ornamental work.

PROCESS 17.

To make a Stone Body.

Take 480 Parts of Cornish Stone.
250 - - of Blue and Brown Clay.
240 - - of Cornish Clay.
10 - - of Glass.
1 - - of Blue Calx.

This body will be sufficiently vitrified at the temperature of the earthenware biscuit oven, and is properly adapted for the purpose of manufacturing jugs, mugs, &c.; it is requisite to place rings on each piece of ware, in order to keep them from being crooked when burnt in the oven; in all other respects to be treated as earthenware bodies.

PROCESS 18.

To make a Stone Mortar Body.

Take 480 Parts of Cornish Stone.
250 - - of Blue and Brown Clay.
240 - - of Cornish Clay.
10 - - of Glass.

This body is principally used for making stone mortars, and when burnt is of a yellowish white, absolutely vitrified, exceedingly strong, very durable, and produces a clear bell sound.

PROCESS 19.

To make a Black Egyptian Body.

Take 235 Parts of Blue Clay.
225 - - of Calcined Ocher.
45 - - of Manganese.
15 - - of Cornish Clay.

There is not, perhaps, a body in the manufacturing of porcelain or earthenware that requires the materials to be more accurately examined than this, principally on account of the manganese, which ought to be free from lime, or any other calcarious earth; ore of manganese appears to exist in a calcined state, but contaminated with earths or metallic matters; there are white, red, brown, and black ores, consequently the ore used should be as pure as possible from calcarious earth, for this obvious reason—the pieces of ware, when manufac-

tured, are very apt to crack, because of the sudden transition from heat to cold, provided above a certain proportion of lime, or any other calcarious earth, be contained in the manganese. This kind of earthenware requires only once burning, after which it is scoured with fine sand, and then a small quantity of oil rubbed over it.

PROCESS 20.

To make a Ring Body.

Take 150 Parts of Blue Clay.
100 - - of Cornish Stone.
100 - - of Bones.
52 - - of Plaster.

This body is for the purpose of making rings and setters, used in placing porcelain and iron stone; likewise, the porcelain clay which gets dirty or injured by working may be used for the same purpose, in the proportion of two of the former to one of the latter.

PROCESS 21.

To make a Saucer Mould Body.

Take 10 Parts of Flint.
4 - - of Blue Clay.
2 - - of Cornish Clay.
1 - - of Black Clay.

This body is prepared for the sole purpose of making moulds, principally those of saucers; in some instances, it is preferable, and considerably more durable than those which are made of plaster; the contraction of this clay in burning is inconsiderable.

PROCESS 22.

To make a Fawn Porous Body.

Take 40 Parts of Argillaceous Clays.
4 - - of Blue Clay.
2 - - of Flint.

This body makes porous wine and butter coolers and water bottles, on the principle of absorption and evaporation; they are generally ornamented with various coloured clays, according to the five recipes below,; the coolers and bottles should be kept in the wet clay state, at the time of being painted, otherwise the different colours laid upon them, will not sufficiently adhere together, but are liable to chip and peel off when burnt. A moderate degree of heat must be applied, as too great a temperature will cause the body to be too dense, and prevent absorption; therefore, it will be indispensably necessary to fire such articles in the easy parts of an earthenware biscuit oven.

These proportions produce different effects; the clay in which the silicious ingredients enter in proportion of three to one are the best for the use of porcelain; those in which argil exceeds are the best for coarser earthenware, because less acted upon by alkalies. That kind of silicious stone which constitutes the sandy parts of clays, should be attended to particularly; it is frequently found that quartz or felspar, and some other species, will influence the internal properties of the clays. The colours that occur in clays are numerous; those produced by vegetables or bituminous particles are destroyed by heat in an open fire, and are by no means prejudicial; but those which arise from metallic particles are obstinate, and should be avoided as much as possible. With respect to clays which contain argil and silex only, they will not melt with any heat that can be produced in kilns or ovens in potting, in whatever proportion they may be mixed together; but calcarious earths in the proportion of ten to twelve per cent. will render any clay fusible. There are few clays but what contain either more or less calcarious earth. The clays for manufacturing porcelain should be those which contain the most sand, and are of the greatest fineness, also such as do not retain water with too much tenacity, which is the case when argil is not combined with fixed air, therefore all clays ought to be exposed to the action of the atmosphere for a long time previous to using. White is the natural colour of all earths, other colours which are found in them proceed from inflammable or metallic sub-

stances. Calcarious earth, in its common state, is lime stone or spar, magnesia or muriatic earth, which, in their pure state, are not so easily dissolved as when combined with fixed air. Earth of argil forms the basis of common alum, and by some called aluminous earth, which in part is common clay; to distinguish it from other heterogeneous parts it is called argil, and is never found pure; the finest part is extracted from alum, and not fusible in the strongest heat required for china or earthenware. Argil in its usual state of dryness, is capable of absorbing two and a half times its weight of water. Silicious earths found in a stony state abound in flint, for which reason they are called silicious; the purest are found in crystals and quartz of a pure white colour. Fixed alkalies, vegetables, or minerals, are the true solvents of silicious earths. It should be understood that flint and bones, in all instances, are to undergo the process of calcination previous to using.

SECTION II.

RECEIPTS for superior and common Glazes of Porcelain, Iron Stone, Earthenware, and various Coloured Drabs, properly adapted for the Bodies described in the first part of this Book.

PROCESS 28.

To make a superior Porcelain Glaze.

Take 40 Parts of Cornish Stone.

45 - - of Red Lead.

38 - - of Borax.

32½ - - of Flint.

22½ - - of Flint Glass.

13 - - of Crystal of Soda.

5 - - of Oxide of Tin.

1 - - of Enamel Blue.

In the preparation of these materials follow the method described in the subsequent observation; the particles made small and well mixed up together, then calcined in the coolest part of the glazing oven, in seggars thickly lined with flint;

care must be observed, that the frit is not too highly calcined, or brought into a high state of vitrification, if so, it will render it difficult to grind and injure its good qualities in dipping. The frit likewise if too finely ground, will cause the glaze not to be even on the surface of the ware; provided any inconvenience of this nature arises, by adding a solution of potash in hot water, that defect will be instantly obviated.

PROCESS 29.

To make a superior Iron Stone Glaze.

Take 36 Parts of Cornish Stone.
30 - - of Borax.
20 - - of Flint.
15 - - of Red Lead.
6 - - of Crystal of Soda.
5 - - of Oxide of Tin.
$\frac{1}{8}$ - - of Blue Calx.

In the preparation of these materials, follow the method described in the preceding observation on porcelain glaze; then, with the above frit is to be added 15 parts of white lead, 10 parts of Cornish stone, 10 parts of flint; when ground together, the composition is ready for use; should the glaze prove too thin for dipping, add a small quantity of muriatic acid.

PROCESS 30.

To make a Frit used in Bodies.

Take 60 Parts of Cornish Stone.
40 - - of Flint.
30 - - of Crystal of Soda.
8 - - of Oxide of Tin.
10 - - of Borax.

This frit is used in small quantities, in china and iron stone bodies.

PROCESS 31.

To make a Frit for Glazes.

Take 40 Parts of Cornish Stone.
36 - - of Flint Glass.
20 - - of Red Lead.
20 - - of Flint.
15 - - of Potash.
10 - - of White Lead.
3 - - of Oxide of Tin.

This frit is intended to be used in glazes, in lieu of those which contain a large proportion of borax; therefore, by substituting it when the price of that article is high, will, of course, be advantageous, and still the texture of the glaze will be good and admissible.

PROCESS 32.

To make a Frit for Glazes.

Take 36 Parts of Cornish Stone.
30 - - of Red Lead.
20 - - of Flint.
20 - - of Borax,
15 - - of Crystal of Soda.
5 - - of Oxide of Tin.

The two annexed Processes of frit, used in different glazes, may be calcined in the easy part of the glazing oven, in seggars lined with flint; particular care should be observed, that they are clean chipped, and free from pieces of seggars, or any dirty substance.

PROCESS 33.

To make a Superior Earthenware Printed Glaze.

Take 90 Parts of White Lead.
35 - - of Cornish Stone.
20 - - of Flint Glass.
20 - - of Flint.
60 - - of Frit. Process 32.
$\frac{1}{4}$ - - of Blue Calx.

PROCESS 34.

To make an Earthenware Printed Glaze.

Take 85 Parts of White Lead.
35 - - of Cornish Stone.
22 - - of Flint.
15 - - of Flint Glass.
24 - - of Frit. Process 32.
$\frac{1}{5}$ - - of Blue Calx.

These two printed glazes when ground, to be sifted through a fine No. 16 lawn; the former glaze is of the finest texture, and will require rather a thinner coating than those of common glazes, *(when dipped.)* These glazes fire in seggars, either washed with common glaze, or a mixture of lime and slip without flint.

PROCESS 35.

To make a Common Printed Glaze.

Take 90 Parts of White Lead.
45 - - of Cornish Stone.
22 - - of Flint.
20 - - of Flint Glass.
$\frac{1}{4}$ - - of Blue Calx.

To this printed glaze, after being properly ground and sifted, add 1 lb. of common salt, and $\frac{1}{2}$ lb. of borax, which forms a smear or flow, as it is generally termed, but must not be put

into the glaze until the blue stain is perfectly incorporated with it; the ware dipped therein must be placed in seggars washed with glaze.

PROCESS 36.

To make a White Earthenware Glaze.

Take 35 Parts of Cornish Stone.
20 - - of Borax.
10 - - of Crystal of Soda.
20 - - of Red Lead.
$\frac{1}{8}$ - - of Blue Calx.

These materials being calcined in the manner before described, then pulverized coarsely, and ground with the following articles—20 lbs. of white lead, 10 lbs. of cornish stone, and 5 lbs. of flint, produce a fine white glaze, particularly well adapted for enamelling, the colours and lustres work to advantage, whilst the surface of the ware is kept even; to be fired in seggars washed with lime and slip.

PROCESS 37.

To make a Blue and Green Edge Glaze.

Take 72 Parts of Litharge.
36 - - of Cornish Stone.
20 - - of Flint Glass.
17 - - of Flint.
12 - - of Frit. Process 32.
$\frac{1}{5}$ - - of Blue Calx.

The blue and green edged ware when dipped in this glaze should be perfectly dry previous to being placed in the seggars, and the green edge should be seated in the coolest part of the glazing oven.

PROCESS 38.

To make a Superior Cream Colour Glaze.

Take 85 Parts of White Lead.
40 - - of Cornish Stone.
22 - - of Flint.
16 - - of Flint Glass.
8 - - of Frit. Process 32.

PROCESS 39.

To make a Common Cream Colour Glaze.

Take 75 Parts of Litharge.
40 - - of Cornish Stone.
23 - - of Flint.
10 - - of Flint Glass.

The two processes of cream colour glazes will be found very good, particularly the former, which makes a fine smooth glaze, and produces in the ware a rich appearance.

PROCESS 40.

To make a fine Crystal Glaze.

Take 105 Parts of Cornish Stone.
90 - - of Borax.
60 - - of Flint.
50 - - of Red Lead.
12 - - of Crystal of Soda.
10 - - of Oxide of Tin.
$\frac{1}{4}$ - - of Blue Calx.

This glaze produces very superior white earthenware, and, for the purpose of enamelling, the colours, lustres, and burnished gold appear to considerable advantage; it is also adapted for iron stone, and makes superior blue printed earthenware; it has a singularly striking effect on printed brown and mulberry. When used for dipping it must be considerably diluted, and requires but little shaking from the hand of the operator; it requires the heat of a china glazing oven, but to answer the earthenware oven it will require a small addition of white lead, according to the temperature of firing. The materials must be mixed and calcined as before stated, and the ware fired in lime and slip seggars, well washed.

PROCESS 41.

To make a Brown Cottage Glaze.

Take 60 Parts of Litharge.
32 - - of Flint.
8 - - of Brown Slip.

PROCESS 42.

To make a Calcedony Glaze.

Take 65 Parts of Litharge.
40 - - of Cornish Stone.
20 - - of Flint.
6 - - of Frit. Process 32.

PROCESS 43.

To make a Drab Glaze.

Take 70 Parts of Litharge.
30 - - of Flint.
25 - - of Cornish Stone.
10 - - of Drab Slip.

The three coloured glazes as above, require using about the same consistency as the cream colour glaze, and will stand the highest temperature of heat in a common glazing oven.

PROCESS 44.

To make a Blue Glaze.

Take 50 Parts of Flint.
30 - - of Borax.
22 - - of Red Lead.
10 - - of Cornish Stone.
6 - - of Crystal of Soda.
6 - - of Oxide of Tin.
3 - - of Blue Calx.

In preparing the last receipt follow exactly the same directions as were given for the porcelain glaze, process 28, throughout the operation. This glaze has a most beautiful effect on china and earthenware bodies.

PROCESS 45.

To make a Green Glaze.

Take 3 Parts of Blue Vitrol, Calcined.
1 - - of Flint Glass.
1 - - of Flint.

When ground, take four quarts of the above mixture to thirty quarts of the following mixture, ground, viz. :—

Take 35 Parts of Litharge.
20 - - of Flint.
10 - - of Cornish Stone.
10 - - of Frit. Process 32.

This glaze is sufficiently fired in the coolest part of the glazing oven. Particular attention should be observed as to the proper wash used for the seggars, for much depends on that simple process. The brightness and lustre of the glaze will be secured by adopting the following wash :—five parts of the solution of quick lime, one part of clay slip, free from the least particle of flint, and applied about the thickness of common glaze.

PROCESS 46.

To make a Yellow Glaze.

Take 95 Parts of White Lead.
35 - - of Flint Glass.
20 - - of Flint.
14 - - of Oxide of Yellow.
10 - - of Cornish Stone.
16 - - of Frit. Process 32.

The oxide of yellow must be very finely ground, and the other materials ground and sifted before the oxide of yellow is added. It would be as well first to mix the yellow and the frit together, then let them be passed through a lawn into a vessel containing the other ingredients; by this means the materials will be better incorporated; use it about the same thickness as cream coloured glaze, and treat it the same. It will fire almost in any part of the oven, in seggars either washed with glaze or mixture of lime and slip.

PROCESS 47.

To make an Alkaline Glaze.

Take 30 Parts of Borax.
30 - - of Flint..
18 - - of Cornish Stone.
2 - - of Oxide of Tin.

This glaze is in reality produced by the mixture of an alkali with earths. Although placed last in the scale amongst those receipts, yet its intrinsic properties are of the first consequence to the potter. This valuable and important discovery happened some years ago; and some pieces of ware dipped in it have been in wear for a considerable time; its durability, solidity, and colour surpass any other. Strange as it may appear that so serviceable an article has not been adopted, it may be accounted for on the ground that circumstances and opportunity have been the sole preventatives. In point of preparation, the materials must be calcined after the methods before described, but particular caution must be strictly observed in the course of chipping from the seggars, that not the least particle of any colouring matter be mixed with it, for it is very susceptible of being materially injured in its colour; when ground, a small quantity of muriatic or nitrous acid should be added, and at the same time quickly stirred about, and the motion continued for some time, in order to prevent it setting at the bottom of the vessel; in all other respects treated the same as com-

mon glazes, except with regard to dipping, in which case it must be used very thin indeed, as the buiscuit ware will only require a very thin coating, so much so, that one hundred weight of this alkaline glaze will cover as great a surface of the buiscuit ware as two hundred weight of common cream coloured glaze; besides the advantage it has of producing a fine surface. The texture is much superior to porcelain glazes in point of hardness.

Having closed the diversified Receipts of Glazes, a few additional observations will perhaps be consistent, relative to their properties and component parts:—A glaze must first be composed of those materials adapted to the nature of the porcelain or earthenware, for every one is not suitable to this purpose, consequently it is frequently found that a glaze which will answer the purpose for one porcelain or earthenware body, will prove a bad one for another; one will crack and fracture, or as the potters term it *craze*, in many places, producing no lustre and containing many bubbles; it is evident then, that such a glaze must be appropriated to each porcelain or earthenware body as will be suitable to its hardness and density, also to the ingredients of its composition, &c. Much depends on the body and the glaze of the ware possessing the property of equally expanding by increase of temperature; if they differ in this respect, the glaze will infallibly crack and fracture during the time of cooling.

The purest blue calx undoubtedly should be used for the staining of glaze, and considering the various qualities of that article when manufactured, the proportion to each receipt of glaze will be found as accurate as possible under such circumstances.

Zaffre blue, as well as cobalt blue, are oxides of cobalt, but in a less state of purity. Tincal may be substituted for borax. Red lead in all calcinations as frits and glazes, answers equally the same purpose as white lead. Litharge also may be applied in all common glazes, in the place of white lead. The two ingredients in general used as a wash for seggars, are a mixture of lime and slip, or common glaze, but ground bones are unquestionably the best.

SECTION III.

RECEIPTS for Enamel Colours, and Colours under Glaze, Burnished Gold, and Lustres; also printed Blue, Brown, and Mulberry, and various fluxes; together with Solutions and Oxides of various Metals.

PROCESS 48.

To make a Naples Yellow under Glaze.

Take 12 Parts of White Lead.
2 -- of Diaphoretic Antimony.
1 -- of Crude Sal Amonic.
$\frac{1}{2}$ -- of Alum.

It is requisite that the ingredients for this colour be finely mixed up together, and calcined in a crucible, over a slow fire, for the space of three hours, stirring it nearly the whole of the time, when the mass will be found of a beautiful yellow or gold colour.

PROCESS 49.

To make a lining Brown under Glaze.

Take 7 Parts of Glass of Antimony.
3 -- of Raw Litharge.
$2\frac{1}{2}$ -- of Manganese.
1 -- of Nitre.
1 -- of Blue Calx.

PROCESS 50.

To make a Painting Brown under Glaze.

Take 5 Parts of Glass of Antimony.
5 - - of Raw Litharge.
2 - - of Manganese.
½ - - of Blue Calx.

PROCESS 51.

To make an Orange under Glaze.

Take 6 Parts of Raw Litharge.
4 - - of Crude Antimony.
2 - - of Crocusmartis.
1 - - of Oxide of Tin.

PROCESS 52.

To make a Yellow under Glaze.

Take 4 Parts of Raw Litharge.
3 - - of Crude Antimony.
1½ - - of Oxide of Tin.

PROCESS 53.

To make a Green under Glaze.

Take 12 Parts of Oxide of Yellow.
4 - - of White Enamel.
2 - - of Frit. Process 32.
1¼ - - of Blue Calx.

The ingredients for the preceding colours under glaze, with the exception of the green, should be mixed together and calcined in a reverberatory furnace or glazing oven, in seggar hillers, or dishes lined with flint; then spread on the mixture about an inch in thickness, observing that the hiller or dish have a sufficient access of air allowed, to prevent the metals from reviving again in their metallic state: the green ingredients only require grinding.

PROCESS 54.

To make a Printing Brown under Glaze.

Take 5 Parts of Raw Litharge.
5 - - of Crude Antimony.
$2\frac{1}{2}$ - - of Manganese.
1 - - of Blue Calx.

PROCESS 55.

To make a Printed Black under Glaze.

Take 3 Parts of Red Lead.
$1\frac{1}{4}$ - - of Antimony.
$\frac{3}{4}$ - - of Manganese.

After these ingredients have been calcined, add the following, and calcine again:

2 Parts of Blue Calx.
$\frac{1}{4}$ - - of Oxide of Tin.

This black under glaze, in the last stage of preparation, must be calcined in the highest heat of a biscuit oven, and the glaze which is the most suitable to it is the crystal one, process 40; the ware must be fired in an easy part of the glazing oven: the brown calcined in the usual way, and dipped in the common printed glaze.

PROCESS 56.

To make a Printed Mulberry under Glaze.

Take 4 Parts of Manganese.
2 -- of Blue Calx.
1 -- of Nitre.
$\frac{1}{2}$ -- of Borax.

Calcine this colour in the usual way, either in a dish or seggar hiller, and after the mixture is spread on the dish or hiller, a small quantity of pounded nitre should be scattered thinly over, and when calcined, add two parts of flint glass, one part of flint; then grind all the ingredients up together for use.

PROCESS 57.

To make a Green for Edging under Glaze.

Take 3 Parts of Oxide of Copper.
3 -- of Flint Glass.
2 -- of Flint.
2 -- of Oxide of Tin.
1 -- of Enamel Blue.

These ingredients grind together, after which add the following mixtures, viz. eight quarts of printed glaze, process 34, and four quarts of cream colour glaze, process 38, mixed well together, and sift them through a fine lawn, lay this green on the ware after it is dipped, and fire it in the coolest part of the glazing oven.

PROCESS 58.

To make a Blue Printed Flux.

Take 3 Parts of Flint Glass.
2½ - - of Flint.
1 - - of Nitre.
1 - - of Borax.

PROCESS 59.

To make a Blue Printed Flux.

Take 2 Parts of Flint.
1 - - of Frit. Process 32.
½ - - of Flint Glass.

PROCESS 60.

To make a Blue Printed Flux.

Take 5 Parts of Flint.
1½ - - of Borax.
½ - - of Nitre.

PROCESS 61.

To make a Painting and Edging Blue.

Take 2 Parts of Blue Calx.
3 - - of Frit. Process 32.
1½ - - of Flint Glass.
1 - - of Flint.
½ - - of White Lead.

PROCESS 62.

To make a Strong Printing Blue.

Take 2 Parts of Blue Calx.
3 - - of Printed Flux either 58 or 59.

PROCESS 63.

To make a Brosely or Weak Printing Blue.

Take 1 Part of Blue Calx.
4 - - of Printed Flux. No. 60.

These several processes are essentially connected with each other and have the attainment of one and the same purpose in view, therefore are classed in regular succession. The frit No. 32, should be prepared without the oxide of tin, when mixed with the blue calx, for that metal and arsenic are both prejudicial to its colour. Plaster and Flint may be substituted for the preparation of printing blue, but when ground

and dried, it immediately assumes a stony-like hardness very light in its specific gravity, and imbibes an excess of oil before it is in a proper state of consistency for the operator; on trial or by experiment, the colour will be perceptibly weaker or lighter than blue calx, when mixed with a calcined high vitrified flux in the same ratio, the density and compactness of the latter cause it more easily to enter the engraved parts of the copper plate, so that a greater body of blue is of course transferable, and readily contained on the biscuit pieces of ware; consequently the colour when glazed and fired will appear stronger. The two following mixtures are receipts for printer's oil, with proper directions for preparing the same; for some oils which are made use of prove injurious to the tint of the blue. Zaffre blue may be mixed in equal parts with cobalt blue, and the colour will nevertheless be good; for the coarser sorts of earthenware zaffre blue alone is generally used.

PROCESS 64.

To make a Printing Oil.

Take 1 Quart of Linseed Oil.
1 Pint of Rape Oil.
2 Oz. of Balsam Capivi.
1 - - of Pitch.
½ - - of Amber Oil.
½ - - of White Lead.

PROCESS 65.

To make a Printing Oil.

Take 1 Quart of Linseed Oil.
¼ Pint of Rape Oil.
¼ - - of Common Tar.
1 Oz. of Balsam Sulphur.
1 - - of Balsam Capivi.

The principal object in the preparing of these oils is the care required in adding the different ingredients at proper times; first, the linseed oil should be boiled for some time alone, then may be added the rape oil and the balsam of capivi, after which allow the boiling to be continued until it begins to approach the proper consistency, which is known by taking out at intervals a small quantity, then may be added the remaining ingredients, but the mixture should be allowed to cool a short time, after which the whole mass may be boiled slowly until it has assumed the proper thickness; let it be observed that the vessel must be generally covered during the process, and the sulphur previously to being mixed with the oil should be perfectly pulverized, as by that means it is less liable to make the oil curdle or coagulate.

PROCESS 66.

To make a Blue Stain.

Take 5 Parts of Blue Calx.
2 - - of Frit. Process 32.
1 - - of Flint Glass.
1 - - of Enamel Blue.

PROCESS 67.

To make a Yellow Stain.

Take 3 Parts of Oxide of Yellow. Process 32.
1 - - of Frit. Process 32.
¼ - - of Chromat of Iron.

PROCESS 68.

To make a Green Stain.

Take 3 Parts of Blue Stain.
1 - - of Yellow Stain.
½ - - of Enamel Blue Green.

In preparing these stains the ingredients must be ground remarkably fine, and then so perfectly dried as not to leave the least humidity, after which they must be ground again with oil prepared for the purpose, composed of two parts of balsam of sulphur, one part of amber oil, and as much turpentine as will render it of a proper consistency, it may then be used with ease for painting various devices on biscuit ware.

PROCESS 69.

To make an Enamel Flux.

Take 8 Parts of Red Lead.
6 - - of Flint Glass.
3 - - of Borax.
3 - - of Flint.

PROCESS 70.

To make an Enamel Flux.

Take 7 Parts of Red Lead.
4 - - of Borax.
$2\frac{1}{4}$ - - of Flint.

PROCESS 71.

To make an Enamel Flux.

Take 4 Parts of Borax.
3 - - of Red Lead
3 - - of Flint Glass.
2 - - of Flint.

PROCESS 72.

To make an Enamel Flux.

Take 3 Parts of Red Lead.
1 - - of Flint Glass.
1 - - of Flint.

PROCESS 73.

To make a Gold Flux.

Take 11 Parts of Borax.
5½ - - of Litharge.
1 - - of Oxide of Silver.

In these enamel fluxes the materials are to be made very fine particularly the flint, and mixed well together, so that the particles may more easily concrete when in a state of fusion, then calcined in an air furnace or an earthenware glazing oven, when the whole mass by means of the proper temperature of fire will be changed into a brittle resplendent and transparent glass.

PROCESS 74.

To make Smalts.

Take 32 Parts of Sand.
32 - - of Potash.
10 - - of Borax.
1 - - of Blue Calx.

These smalts the materials of which are calcined in the usual manner when finely pulverized, will produce a fine rich looking blue powder.

PROCESS 75.

To make a Venetian White Enamel.

Take 3½ Parts of Flint.
3 - - of Borax Calcined.
1 - - of Cornish Stone.
½ - - of Oxide of Tin.

PROCESS 76.

To make a Common White Enamel.

Take 8 Parts of Flint Glass.
2 - - of Red Lead.
½ - - of Nitre.
½ - - of Arsenic.

These white enamels require the materials to be made very fine and calcined in air furnace, the heat at first to be generated very gradually, and when the whole mass is in a state of fusion increase the fire quickly, and there will soon be produced a fine white enamel; in the time of fusion it will be requisite to keep stirring the whole together with an iron spatula or rod.

PROCESS 77.

To make an Enamel Blue.

Take 16 Parts of Flint Glass.
5 - - of Red Lead.
2 - - of White Enamel.
2 - - of Blue Calx.
1 - - of Common Salt.
1 - - of Potash.

PROCESS 78.

To make an Enamel Blue.

Take 16 Parts of Flint Glass.
5 - - of Red Lead.
2 - - of Nitre.
2 - - of Potash.
$2\frac{1}{2}$ - - of Blue Calx.

For these blue enamels the materials must be calcined in an air furnace or glazing oven, and caution should be observed that they are not too finely ground at the mill, in order to prevent it from crazing or chipping after being burnt on the pieces of ware, which this colour is very susceptible of doing.

PROCESS 79.

To make an Enamel painting Black.

Take 4 Parts of Borax.
2 - - of Umber Calcined.
2½ - - of Red Lead.
2 - - of Enamel Blue.
1 - - of Flint.
1 - - of Blue Calx.

PROCESS 80.

To make an Enamel printed Black.

Take 1 Part of Umber Calcined.
1¼ - - of Borax Calcined.
½ - - of Blue Calx.

PROCESS 81.

To make a Superior painted Black.

Take 8 Parts of painted Black.
1 - - of Enamel Blue.
1 - - of Enamel Purple.

PROCESS 82.

To make printing or lining Black.

Take 1 Part of Copper calcined.
3 - - of Flux. Process 69.

The last process, called Copper Black, is a very fine colour, the obtaining of which altogether depends upon a proper temperature of heat being applied, for nothing is more fickle and uncertain, if in the least degree over fired the colour is destroyed, and becomes of a dirty green. The other blacks are called Umber Blacks, and will stand any degree of heat which is required in an enamelling kiln or muffle; process 81 is a fine beautiful black colour, and is adapted for the painting of flowers and landscapes on porcelain. The umber to be highly calcined in a biscuit oven, but particular caution should be observed that it is the real Turkey umber, and not the English, which is of an inferior quality. The two first enamel blacks to be calcined in the usual way; the materials of the two latter only want grinding.

PROCESS 83.

To make an Enamel Red.

Take 1 Part of Green Copperas Calcined.
3 - - of Flux. Process 71.

The greatest difficulty in preparing red is the calcination of the copperas; calcine the copperas in a vessel exposed to the heat of an open fire, by which means it will dissipate all its volatile contents, and leave a residue of oxide of iron in powder, when it attains an orange or light red, the calcination is sufficiently accomplished, the residue is then washed repeat-

edly with boiling water, until the water becomes insipid and free from vitriolic acid.

PROCESS 84.

To make an Enamel Light Brown.

Take 1 Part of Umber Calcined.
1 -- of Yellow under Glaze.
$\frac{1}{2}$ -- of Copperas Calcined Red.
$\frac{1}{4}$ -- of White Enamel.
$5\frac{1}{2}$ -- of Flux. Process 70.
3 -- of Flux. Process 71.

PROCESS 85.

To make an Enamel Dark Brown.

Take 1 Part of Copperas Calcined Brown.
2 -- of Flux. Process 72.
$\frac{3}{4}$ -- of Flux. Process 69.

These browns only require grinding before they are fit for use, the copperas for the purpose of making dark brown, will require calcining in the most intense heat of a biscuit oven; the colour of it varies according to the temperature it undergoes, first white, then orange, red, and lastly brown.

PROCESS 86.

To make an Enamel Blue Green.

Take 42 Parts of Red Lead.
15 - - of Flint.
12 - - of Borax.
$2\frac{3}{4}$ - - of Blue Vitrol Calcined.

To these materials, after being calcined in an air furnace or glazing oven, must be added 12 parts of white enamel, then grind them all together for use.

PROCESS 87.

To make an Enamel Grass Green.

Take $3\frac{2}{3}$ Parts of Blue Green Frit.
1 - - of Enamel Yellow.

PROCESS 88.

To make an Enamel Yellow Green.

Take $2\frac{1}{2}$ Parts of Blue Green.
1 - - of Enamel Yellow.

PROCESS 89.

To make an Enamel Yollow.

Take 1 Part of Naples Yellow.
2 - - of Flux. Process 69.
1 - - of Flux. Process 71.

PROCESS 90.

To make an Enamel Orange.

Take 1 Part of Orange under Glaze.
2 - - of Flux. Process 69.
1 - - of Flux. Process 72.

PROCESS 91.

To make an Enamel Purple Distance.

Take 2 Parts of Enamel Purple.
3 - - of Oxide of Manganese.
12 - - of Flux. Process 71.

In the several annexed Receipts for enamel colours no process of calcination is necessary, the materials being ground together and dried, afterwards mixed up with spirits of turpentine, is sufficient.

PROCESS 92.

To make a Cornelian Red.

Take 1 Part of Chromate of Iron.
$3\frac{1}{2}$ - - of Flux. Process 72.

This fine colour is produced from the chromate of iron, or the yellow oxide of chroma, which has a greater affinity for lead than an alkali, consequently the flux prescribed is the only one which is susceptible of yielding its proper colour, as

those fluxes which contain a large proportion of borax are very prejudicial, destroying the colour, and with the greatest difficulty forming any affinity at all, therefore should be avoided. The flux used should be highly calcined until it assumes a dark orange coloured glass.

PROCESS 93.

To make an Enamel Pomona Green.

Take 1 Part of Oxide of Green Chroma.
2½ - - of Flux. Process 69.
1½ - - of Flux. Process 72.

This fine beautiful green is simply prepared by only grinding the above ingredients, and produces that dark colour equal to the French green, provided the oxide is genuine; and by adding a proportion more of flux and white enamel, there still will be a rich tint, though weaker and lighter in colour.

PROCESS 94.

To make Burnish Gold from Brown Gold.

Take 12 Parts of Brown Oxide of Gold.
8 - - of Quicksilver.
2 - - of Oxide of Silver.
1 - - of White Lead.

Put the whole of these ingredients into an erthenware mortar, and triturate them until the whole is amalgamated, the mercury being the solvent fluid, very readily combines with the rest, to which it communicates more or less of its fusibility, after which, grind them very fine with spirits of turpentine.

PROCESS 95.

To make Burnish Gold from Green Gold.

Take 12 Parts of Green Gold.

7½ - of Quicksilver.

1½ - - of Oxide of Silver.

1½ - - of Gold Flux.

This is prepared first by dissolving and incorporating the gold with the quicksilver, to accomplish which, the gold is put in an earthenware vessel on an open fire, and when heated red hot, take four times its weight of mercury, and pour it in; the mixture, to be stirred with a little iron rod; the gold will be dissolved spontaneously, it is then thrown into a vessel full of water until it coagulates and becomes manageable, much of the mercury is then pressed through a piece of leather, and the rest dissolved by a quantity of nitrous acid, the acid is afterwards poured off, the gold remaining is repeatedly washed with boiling water as often as needful, it is then dried and mixed up with the other ingredients, and ground with spirits of turpentine for use.

PROCESS 96.

To make a Bronze Gold.

Take $2\frac{1}{2}$ Parts of Burnish Gold.
2 - - of Oxide of Copper.
1 - - of Quicksilver.
$\frac{1}{4}$ - - of Gold Flux.

Having dissolved the copper in aqua fortis, it is again separated from its solvent and falls to the bottom of the vessel by the addition of iron,—the precipitate of copper may be increased or diminished at discretion, which makes the bronze richer or poorer in colour according to the proportion of burnish gold contained in the mixture. It is chiefly used for ornamenting the handles and heads of jars, vases, &c. and occasionally intermixed with burnish gold.

PROCESS 97.

To obtain a Solution of Gold.

Take three parts of muriatic acid, and one part of nitric acid; these proportions form an aqua regia, called nitro muriatic acid, the only true solvent of gold. Put 40 dwts. of this mixture in a small bottle, to which add 5 dwts. of grain gold, the solution will immediately commence, and may be observed by the effervescence which arises at the time; when the solution is complete, the whole of the gold will be dissolved, which will be accomplished in about two hours if the acids be genuine, but when they are not, it will be requisite to apply heat to assist in facilitating the solution.

PROCESS 98.

To obtain a Solution and Oxide of Silver.

Take one part of nitric acid, and three parts of boiling water; these proportions form an aqua fortis, which will dissolve one-third of its weight of silver before the acid is perfectly saturated. To precipitate the metal, the solution must be diluted with five times its quantity of water, then add a portion of common salt, stirring it all the time, and immediately a white precipitate will fall to the bottom of the vessel; the liquor must then be decanted off and boiling water repeatedly added, until the water is quite insipid. This precipitate is the pure oxide of silver, and is the same as that used in the preparation of burnished gold and in staining of glass.

PROCESS 99.

To obtain a Solution of Tin.

Take two parts of nitrous acid, and one part of muriatic acid, with an equal part of water; these proportions form an aqua regia; caution should, however, be particularly observed, that the solution is not too hastily effected, if so, the tin will be too much oxidated and too little of it will be contained in the solution; in order, therefore, to obtain a strong solution, (which is so very requisite) add granulated tin by small pieces at a time, so that one piece be dissolved before the next is added. This aqua regia will dissolve half its weight of tin;

the solution, when properly obtained, is of a redish brown or amber colour; but when it assumes a gelatinous substance the solution is defective.

PROCESS 100.

To make an Enamel Purple.

Take 4 Parts of Gold in Solution.
1 - - of Tin in Solution.

To prepare enamel purple the first step is to procure a vessel to contain fifty parts of water about the temperature of blood-heat, to be well mixed with the solution of gold, and then add the solution of tin by dropping it into the menstruum, at the same time constantly stirring it with a strong feather, which will produce a fine purple colour liquor; but it will be necessary to add a few drops of the solution of silver, which will much assist to raise the colour and beauty of the purple; to help the precipitation of the gold from its solvent (provided the precipitation does not immediately take place) add a large proportion of boiling water or a small quantity of sal amoniac and a precipitate will instantly be procured; the clear liquor must then be decanted off, and the boiling water repeated until it is completely insipid. The residue consists of the oxides of gold, tin, and silver in combination, and is the only substance which has the property of communicating the purple colour to enamel glass; after the precipitate is prepared the

flux must be added, the proper quantity will solely depend on the fusibility or softness of the flux, and as the operation in a great measure depends on observation, a few experiments by the operator will be found useful, independent of the accuracy of the receipt. To the purple precipitate may be added from 30 to 45 parts of flux, Process 71, according to the strength of colour intended to be made.

PROCESS 101.

To make an Enamel Rose Colour.

Take 3 Dwts. of Gold in Solution.
60 Leaves of Book Silver.
2½ Lbs. of Flux, Process 69.

To prepare enamel rose colour procure a vessel that will contain 10 parts the quantity of hot water as for the solution of gold, then mix them together while the water is at the temperature of 190 degrees of Fahrenheit's thermometer, add pulverized sal amoniac rather copiously, at the same time briskly stirring the mixture with a strong feather, until the appearance of a decomposition takes place, which will soon be observable by the gold being precipitated from the menstruum in the form of a fine yellow powder; when that is accomplished, let the vessel stand undisturbed a short time to allow the precipitate to subside, then decant the liquor off, and still add boiling water repeatedly to the precipitate until the water is perfectly

insipid ; in the next place put it on a plaster bat to dry, after which it must be mixed up with book silver and flux, according to the proportions given above, and well triturated in a mortar, then send it to the mill to be ground, when it will be in a proper state for use. This colour is supposed to be best when of a purple tinge, which may be produced by merely calcining the preparation to the heat of ignition previous to being ground; if the colour be too dark, it is a demonstration that the mixture does not possess a sufficient quantity of silver ; if on the other hand it is too light, the silver must have been very plentifully added, therefore the operator must add or diminish accordingly. It will not be amiss to remind the young operator of the great danger attending the use of oxide of gold, a caution which ought to be strictly attended to, the gold being precipitated by the means of sal amonic, for which it has an affinity, will consequently readily unite with it, thereby acquiring the property of fulminating, and when gently heated or smartly struck with any hard instrument will immediately detonate. The chief point then to be obtained is to obviate that dangerous quality by depriving the gold of its salt, which may be accomplished by repeated adulteration with boiling water.

PROCESS 102.

To make a Gold Lustre.

Take grain gold and dissolve it in aqua regia, as in process 97; provided the acids are pure, the solution will be readily effected without the assistance of heat. In this solution of gold it will be necessary to add a small portion of grain tin, viz. to 5 dwts. of gold in solution let 5 grains of tin be added; an effervescence takes place when the solution is completed and in a proper condition to be mixed with the balsam of sulphur, &c. Take balsam of sulphur 3 parts, spirits of turpentine 2 parts, mix them well together over a slow fire, the affinity which exists between the balsam and turpentine will soon make the whole incorporate, then gradually drop the solution of gold into the menstruum, and keep stirring it all the time until the whole solution be added; provided this mixture should appear too thick, add more turpentine till a proper consistency takes place, this will be correctly ascertained by observation and experiment. One ounce of gold dissolved in the manner described will make upwards of two pounds weight of prepared lustre, and must be used with turpentine, for all other spirits are injurious.

PROCESS 103.

To make Persian Gold Lustre.

Take any quantity of the precipitate of gold, first mixed with a small portion of fat oil on a flat piece of earthenware. then place it on a stone previously heated, and when the mixture begins to be in an eliquated state, stir it well about with a palette knife, and keep adding more oil by a little at a time, until with the continuance of a gentle heat, it assumes the colour of balsam of sulphur, then add, with a less degree of heat, the turpentine in small quantities. One ounce of the precipitate of gold will make about one pound, more or less, of lustre, having more solidity and opacity than the lustre process 102. The proportions of the fat oil of turpentine to the spirits of turpentine, are one part of the former to three of the latter. This process is as accurately laid down as possible, and the operator will soon make himself thoroughly acquainted with every thing needful by observation and experiment.

PROCESS 104.

To make a Silver or Steel Lustre.

This silver lustre or steel lustre, as it is sometimes called, is prepared by taking platina and dissolving it in aqua regia composed of equal parts of spirits of nitre and marine acid. The solution does not take place with rapidity, and is with difficulty obtained; therefore, to surmount this obstacle, let

the vessel be placed in a sand bath, at a moderate temperature of heat, when the solution will be effected; then take three parts of the spirits of tar, and one part of the solution of platina, mixing the solution with the tar very gradually, for as soon as the combination takes place, an effervescence will arise, the nitreous acid will evaporate and leave the platina in combination with the tar. After the above process has been performed, should the menstruum be found too thin and incapable of using, set it on a sand bath as before for a few hours; the spirit of the tar will evaporate, and by that means a proper consistence will be obtained. It must be used with spirits of tar, as all other spirits would be destructive.

PROCESS 105.

To obtain the Oxide of Platina.

The solution of platina is obtained as described in process 104, and the metal precipitated from its solvent by *(volatile)* sal amoniac. Let the solution fall into a large vessel of water at the temperature of blood heat; the sal amoniac must then be added, and the precipitate will immediately descend to the bottom of the vessel in an orange colour powder; decant off the water, and repeatedly apply to the precipitate boiling water until the water becomes quite insipid; after being gradually dried it is then used for the purpose of producing a silver lustre in the following manner:—viz. first procure brown earthen-

ware of a full soft glaze, and with a broad camel hair pencil lay on all over the piece of ware the platina in solution, and fire it at a strong enamelling heat, by which it will acquire a shining steel colour lustre; then take the oxide of platina mixed up with water to a thickish consistence, and lay it on the steel lustre, as it is commonly called, and fire it again in a kiln or muffle but not to exceed a blood red heat; it is then called silver lustre, being less resplendent, having more solidity and witeness, and a very similar appearance to silver. On all white earthenware the platina in solution is perfectly sufficient to produce a silver lustre.

PROCESS 106.

To procure the Oxide of Tin.

Take any given quantity of grain tin, and granulate it in the following manner: melt the tin in an iron ladle, when in fusion pour it into a vessel full of cold water, by which means the tin will be reduced into small grains or particles adhering to each other, and of course rendered more easy of oxidation; then take a biscuit dish or seggar hiller previously lined with flint, spread it slightly over with pounded nitre, take the granulated tin, and lay it on the dish or hiller about two inches in thickness, adding a little more nitre on the top; one pound of nitre will be sufficient to oxidate five pounds of granulated tin; the dish or hiller containing the tin and nitre are to be calcined

in a reverberating furnace or glazing oven, particular attention is required in seating it, so that there remains plenty of room to admit a free access of air to pass over the metal, otherwise it is impossible to obtain the whole of it in an oxidated state, because the nitre of itself does not contain a sufficient quantity of oxigen. Tin is one of the most difficult metals to oxidate alone; the oxide of tin purchased contains nearly one third of lead; the adulteration is caused by adding lead to facilitate its oxidation. This new method of preparing tin may be considered by the potter as a pure oxide, and its comparative utility in making glazes to that which is manufactured in the common way or purchased is very considerable.

PROCESS 107.

To make Balsam of Sulphur.

Take two parts of the flour of sulphur, and four parts of turpentine, put them in a vessel over a slow fire until the sulphur is completely dissolved; after which add eight parts of linseed oil, and continue the same degree of heat for about one hour; previous to becoming cold strain it through a piece of cloth, thus is obtained what is called the balsam of sulphur.

The balsam of sulphur is likewise prepared in the following manner: take one part of the flour of sulphur, and six parts of essential oil of turpentine; put them in a vessel over a slow fire until the oil boils and the sulphur is totally incorpo-

rated with it, which produces a red balsam; let the mixture cool and the sulphur will fall to the bottom; the liquor is then poured off, fresh oil added, and the same process repeated again. Ten parts of oil are required to one part of sulphur, to keep it in solution when cold; be sure that the oils are perfectly genuine, otherwise the balsam will be spurious, and not fit for the purpose of making gold lustre.

Having closed the various and intricate receipts of enamels, lustres, colours under glaze, fluxes, solutions, and oxides of various metals, &c.; their combinations, names, and uses; in order to make it a little clearer to the reader, let it be observed, that the basis of enamels are alkalies and lead, to which are added other metallic or mineral matters to give them the colour required; as gold for purple and rose colour, cobalt for blue, copper for greens, umber for black, chrome for cornelian red and pomona green, and copperas in various states of calcination for red and brown; gold and platina for lustres, the former for gold and the latter for silver or steel lustre. The enamels, after being finely ground, should be thoroughly dried, then mixed up with turpentine, and used like other colours with a pencil, after which fused again, and vitrified by fire. Spirits of tar may be substituted instead of turpentine in all enamels with the exception of blue, and colours prepared from chrome. With regard to the burning of them, the lustres will bear the highest temperature of an enamelling

heat; the rose colour, cornelian red, and pomona green require a less degree of heat, and are generally seated or placed in the middle of the kiln or muffle, as well as burnish gold; other colours are not so susceptible of being destroyed by heat, consequently they will fire in any part of the kiln or muffle. The even surface of the various coloured grounds on china is produced by first laying the space wanted with linseed oil, previously boiled with a little red lead and a small portion of turpentine; the enamel colour is then ground fine, and dusted on the oiled part with cotton wool, or laid on with a large camel hair pencil. The component parts of the different colours will be found as accurately stated as possible, and in reference to lustres, purple, and rose colour, the preparation principally depends on observation, therefore experiments will be necessary that a proper judgment may be formed, for by discreet combinations and management all those beautiful variety of tints and shades are produced on china which now adorn the tables of the sovereigns of Europe.

SECTION IV.

RECEIPTS for preparing Zaffre and Cobalt Blue, with the various processes of smelting, refining, and Calcining.

PROCESS 108.

To procure the Regulus of Zaffre.

Take 112 Parts of Zaffre.
57 - - of Potash.
18½ - - of Charcoal.

This is the first process towards making blue calx, and is called running down, but more properly smelting. The charcoal being pulverized, and all the materials mixed up together are afterwards put into large sized crucibles capable of holding from three to four quarts, and filled quite full, then placed in a strong brick built reverberating furnace, commencing with a slow fire, and continued for some time, but as soon as it is heated to a red heat, it will then require a considerably stronger fire before the cohesion between the different particles is sufficiently destroyed. This operation will be complete in about ten hours, the weight of the regulus being from

thirty-one to thirty-three pounds; on examining the scoria, if there remains mixed with it small pieces of metal not much unlike small shot, or when pounded, if the scoria has a bluish cast, it is an occular demonstration that the fire has not been strong enough; there is but little danger to be apprehended from the most intense heat, provided the particles in fusion do not perforate the crucibles, which are made of a mixture of marls with a small quantity of sand. At the bottom of each cake of Regulus there will be bismuth slightly adhering, which is easily separated without the application of any great degree of heat, by placing the cakes upon an iron plate or pan, which will soon bring the bismuth into a state of liquifaction, and separated from the regulus.

PROCESS 109.

To refine the Regulus of Zaffre.

Take 50 Parts of Regulus.
6 -- of Potash.
3 -- of Sand.

When the regulus is deprived of its bismuth and pulverized, it is to be well mixed with a quantity of potash and sand, as before mentioned, then put in to considerably smaller crucibles holding about 1½ lb. in each, and fired in a reverberating furnace, commencing with a slow fire and gradually increased for the space of about eight hours; by that time the

regulus will have fallen to the bottom of the crucible, and the scoria found at the top will be of a blackish green, therefore it will be indispensably necessary that another course of refining should take place, in order that the regulus may be obtained in a more perfect state of purity.

PROCESS 110.

To refine the Regulus of Zaffre a second time.

Take 50 Parts of Refined Regulus.
6 - - of Potash.
3 - - of Sand.

These materials to be mixed, fired, and treated in every respect the same as in the former process of refining, but a further fusion is required in order to purge the sulphurous parts which adhere to the metal, and which in consequence of the fluxes attracting and absorbing it, is frequently found mixed with the scoria; the regulus will then be sufficiently purified for the next operation.

PROCESS 111.

To procure Blue Calx from Refined Regulus of Zaffre.

Take 30 Parts of Refined Regulus.
1 - - of Plaster.
½ - - of Borax.

These materials to be made very fine, and exceedingly well mixed up together, after which put the mixture in earthenware biscuit cups made one and a half inch high, 3 inches in diameter, and one-half inch thick, filled nearly to the top, set them in a reverberating furnace, the fire to be increased until the mixture is perceived to be in a state of fusion or eliquated, the same degree of heat must be continued for about six hours afterwards, and then the fire hastily slackened; this operation of calcining will occupy from twelve to thirteen hours; at the top of the cups will be found a blue calx separated from the nickle; but as a large proportion of blue will still remain in the nickle when sunk to the bottom of the cups, it will be necessary in order to procure the whole of the blue contained, to pursue precisely the same method over again, viz. the metal mixed up with the plaster and borax, and calcined in the manner described as before, and then without doubt it will yield all the remainder of the blue, which will be found as before at the top of the cups, and the nickle sunk to the bottom; the blue calx obtained by the first process is the best and purest; however, the first and seconds, as they are called, are mixed together, and sold under the appellation of zaffre blue.

PROCESS 112.

To make Cobalt Blue.

Take 60 Parts of Cobalt ore.
50 - - of Potash.
25 - - of Sand.
10 - - of Charcoal.

Let these materials be mixed well together and put into crucibles considerably smaller than those adopted for the smelting of Zaffres, about 1½lb. of this mixture will be sufficient in each crucible, the remaining parts of the process are the same in every respect, and to be attended to in the same manner as described in the process of smelting zaffre, when regulus of Cobalt will be properly obtained.

PROCESS 113.

To refine the Regulus of Cobalt.

Take 50 Parts of Regulus.
6 - - of Potash.

The regulus must be pulverized small, and mixed up with the other materials; instead of using crucibles as in the refining of regulus of zaffre, they should be earthenware cuppels in the shape of the old pickle jar or bottle, with a flange top rather larger than half pints, to contain about one pound of the mixture. Cobalt ores vary very much both in the quality and quantity of blue they contain, whether the ore be poor or

rich the same process is to be adopted; the operation of refining must be as often repeated as is necessary, *i. e.* until the scoria is of a bright colour, and of a slight blueish hue, which requires in general about three times, and in some instances five times refining before the regulus is sufficiently purged and purified for the next operation.

PROCESS 114.

To roast refined Regulus of Cobalt.

This process is performed by spreading the purified metal finely pulverized half an inch thick on flat pieces of earthenware covered with flint, and placed in a reverberating furnace, and a moderate degree of heat applied for a few hours; care and observation will be particularly required that the metal by an excess of heat does not get into a state of liquifaction, if so, the object will be defeated by expelling the arsenic which it contains; the metals from which the cobalt is with the greatest difficulty disengaged are arsenic and nickle, the former is effected by being exposed to a gentle heat, which is called roasting, the latter by repeated fusions and calcining or calxing.

PROCESS 115.

To procure Blue Calx from the refined Regulus of Cobalt.

Take 30 parts of refined Regulus.

1 - - of Plaster.

$\frac{1}{2}$ - - of Borax.

The regulus after being calcined (which is also called roasting) is to be pulverized quite fine and completely mixed with the plaster and borax, and the same method strictly adopted and observed as that pursued in calxing the refined regulus of zaffre, and as both preparations are in reality perfectly alike, consequently the operator cannot do better than refer to that process.

Having thoroughly described the method of manufacturing cobalt and zaffre blue, through various and intricate processes, together with the mode of operation, it would be impossible to state the exact quantity of fire required in each operation, for the effect of the fire bears an exact proportion to the mass of the body, the size of the furnace, and the strength of the fire employed.

Zaffres are of a dark grey colour about the fineness of sand. Cobalt ores are of a grey colour, shining, hard and ponderous; certain arsenical ores which are similar in appearance have frequently obtained the name of cobalt, but falsely; calx of cobalt and zaffre dissolve in the marine acid in great abundance, if the solution be green it is owing to the calx containing nickle; if it be pure, the solution yields crystals of a red colour inclining to blue.

SECTION V.

Painting and Staining of Glass.

INTRODUCTION.

THAT this is one of the most ancient of the fine arts can scarcely be doubted, and it is even probable that immediately after the invention of making glass would follow attempts to colour and ornament it. The opinions as to its origin are as various as they are numerous. Anthony Neri who flourished in the fifteenth century, stated it to be as old as the time of Job, that divine author making mention of it; we have the very manner of the invention described by Pliny, who informs us that Sidon, in Syria, was famous for glass, and glass houses, it is very likely this was the first place where glass was manufactured, the same being positively asserted by various historians. A moment's reflection on its nature and manner of production would almost induce one to believe it nearly coeval with the art of potting, and the making of bricks, for scarcely can a kiln of either be burnt, but glass must be superficially formed about those parts where the fire has been the most intense, and from the various and numerous combi-

nations that will produce it under sufficient heat, together with the simple and easy method of its formation. The primitive method of painting glass, (or rather of the most ancient production met with) was quite simple; to accomplish the representation of any object, they merely arranged in some sort of order, different pieces of glass of various colours, upon which they added bold and striking shades with a chaste colour using it throughout the design, there are some specimens wherein this colour has been used alone on plain glass, and the effect produced is really great considering the simplicity of the style; this method is generally looked upon as the original. Thus far the ancients proceeded in water colours which they had a most excellent method of causing to adhere firmly to the glass. In the course of time the art was greatly improved, methods having been discovered of incorporating the colours with the glass itself, thereby producing in it the most beautiful and vivid tints; the art was then found applicable to the adorning of churches, palaces, &c. and soon attracted the taste of the great and opulent; it is somewhat singular that in most of these ancient productions we should see such excellent colours, and at the same time the design and execution generally stiff and ill proportioned, although the taste for painting and sculpture at that time was extremely correct; they had two ways in which they produced these colours, in one the colour was diffused throughout the substance of the glass, in the other, the colour was given by coating the glass on one side not more

than one third of a line in thickness with a peculiar vitrious mass prepared for the purpose. The modern method of practising this art is very different from that of the ancients, all their principal colours were made at the glass houses, and amongst their works there is scarcely to be seen two ground colours on the same piece of glass, where as it is now possible to produce every colour used in the art on the same piece, then by the aid of vitrious colours of easy fusion, and the great facility which various stains can be given to glass, we are enabled to complete a figure or landscape, with every species of ornament on a single pane; a circumstance with which the ancients were not acquainted. These colours are composed of various glasses which perfectly vitrify at a low temperature, and contain metallic oxides which are the colouring matter. The principal stains are produced by the oxides of gold, silver, copper, tin, and iron. That beautiful tinted ruby colour stain of the ancients, was produced by a due proportion of the oxides of gold and silver; it has been attempted in the present day, with tolerable success, but it is more than probable the composition of the glass itself renders it a critical operation, and difficult to accomplish; other particulars respecting the proper treatment of the colours and stains will be found to accompany each process, or at the conclusion.

RECEIPTS

Of Stains and Enamel Colours for Painting Glass, also the Process of Etching and Coating Glass.

PROCESS 116.

To make Red, Orange and Yellow Stains for Glass.

Take 12 Parts of Green Vitriol Calcined.

1 -- of Oxide of Silver.

To prepare these stains the vitriol must be calcined to a redish colour, and repeatedly washed with boiling water until it is completely freed from its acid, which will be known by the water being insipid to the taste, then triturate the silver and vitriol together in a mortar, after which grind them up with spirits of tar for use. If the design on the glass is to be figures or landscapes, the stain is laid on in various thicknesses conformable with such design, and when the glass is burned, the stain or coating is washed off with warm water which will bring to view every part of the figure, &c. in fact, every shade according to the different strength of colour laid on the glass; in order to heighten the colour of the stain, it will be necessary to paint on each side of the pane of glass and burn it a second time, after which, the painting as well as the colour of the stain will be found considerably improved; but what is most surprising, the proper tints and shades will be produced without the use of any enamels, this may appear

inconceivable to those who have not seen the operation; provided a solid mass of stain is wanted on a pane of glass, the whole must be covered over the one-sixteenth part of an inch thick; various temperatures in burning produce various coloured stains, the highest a red, a less an orange, and so on to a yellow; but to procure a very deep red, the colour must be laid upon both sides of the glass. After the glass is burned it requires great precaution in cooling, for if suddenly cooled, it is apt to fly, consequently all sudden transition should be avoided.

PROCESS 117.

To make a White Enamel for painting Glass.

Take 3 Parts of Borax Calcined.
2 - - of Flint.
1 - - of Oxide of Tin.
1 - - of Cornish Stone.

The basis of this enamel, which is in general opaque, may also be employed in assimilating the opaque natural stones. These ingredients must be well mixed up together, and fused in an air furnace in a crucible, the fire at first applied very gradually, and the whole repeatedly stirred with an iron rod. The mixture by this calcination, and by being kept for some time in fusion in an intense heat, acquires its fusibility and opacity.

PROCESS 118.

To make Enamel Purple for painting on Glass.

Take 20 Parts of Prepared Purple.

$2\frac{1}{2}$ - - of Flux. Process 70.

1 - - of White Enamel. Process 117.

PROCESS 119.

To make Enamel Purple for Painting on Glass.

Take 20 Parts of Prepared Purple.

10 - - of Enamel Blue Process.

$5\frac{1}{2}$ - - of Flux. Process 70.

1 - - of White Enamel. Process 117.

PROCESS 120.

To make an Enamel Rose Colour for Painting on Glass.

Take 20 Parts of prepared Rose Colour.

1 - - of White Enamel. Process 117.

The purples and rose colours for glass painting are the same mixtures nearly as those used for porcelain painting, with the addition of a small proportion of flux and white enamel, the latter of which gives them more solidity and firmness when applied to the glass: in the course of working the rose colour, if a very small quantity of purple be added, the colour will be perceivably benefited.

PROCESS 121.

To make Enamel Red for Painting on Glass.

Take 1 Part of Terra de Sienna.
3 - - of Flux. Process 70.

The terra de sienna must be calcined over a slow fire until its colour becomes of a dark red, after which washed several times in boiling water and ground with the flux for use.

PROCESS 122.

To make an Enamel Transparent Orange for Painting on Glass.

Take 1 Part of Oxide of Silver.
10 - - of Flux. Process 70.
10 - of Flux. Process 71.
1 - - of White Enamel. Process 117.

PROCESS 123.

To make an Enamel Yellow for Painting on Glass.

Take 1 Part of Yellow. Process 52.
3 - - of Flux. Process 70.
½ - - of White Enamel. Process 117.

PROCESS 124.

To make Enamel Dark Brown for Painting on Glass.

Take 1 Part of highly Calcined Copperas.

$3\frac{1}{2}$ - - of Flux. Process 71.

PROCESS 125.

To make an Enamel Red Brown for Painting on Glass.

Take 1 Part of Black. Process 130.

1 - - of Red. Process 121.

1 - - of Flux. Process 72.

PROCESS 126.

To make an Enamel Light Brown for Painting Glass.

Take 1 Part of easy Calcined Umber.

$3\frac{1}{2}$ - - of Flux. Process 70.

PROCESS 127.

To make an Enamel Green for Painting Glass.

Take 5 Parts of Cornelian Red.

1 - - of Prepared Purple.

PROCESS 128.

To make an Enamel Green for Painting on Glass.

Take 2 Parts of Blue. Process 129.

1 - - of Yellow. Process 123.

The several annexed receipts of enamel glass colours are prepared principally with oxides, enamels, and fluxes, in various combinations, and only require grinding before they are in a fit state for use.

PROCESS 129.

To make an Enamel Blue for Painting on Glass.

Take 8 Parts of Flint Glass.
3 - - of Red Lead.
1 - - of Potash.
1 - - of Blue Calx.
½ - - of Common Salt.

PROCESS 130.

To make an Enamel Blue for Painting on Glass.

Take 4 Parts of Borax.
4½ - - of Flint Glass.
1 - - of Flint.
½ - - of Potash.
½ - - of prepared Purple.
1 - - of Blue Calx.

In preparing these blues, let the materials be calcined in an air furnace, and the whole mass kept in a state of fusion for some time, and then a fine blue glass enamel will be produced, the cobalt blue calx should be of the finest quality that possibly can be procured, and free from all impurities.

PROCESS 131.

To make an Enamel Black for Painting on Glass.

Take 1 Part of highly Calcined Umber.
2 - - of Calcined Borax.
1 - - of Red Lead.
1 - - of Blue Calx.

Be sure that the best Turkey umber is procured and calcined in the most intense heat that can be produced in an air furnace, after which pounded and mixed up with the other materials, then the whole calcined together in an air furnace, the degree of heat will be sufficient when the whole mass is in fusion.

PROCESS 132.

To make an Enamel Black for Painting on Glass.

Take 1 Part of Manganese.
1 - - of Black Flux.

PROCESS 133.

To make an Enamel Black Flux.

Take 15 Parts of Red Lead.
5 - - of Borax.
5 - - of Flint.
$1\frac{1}{4}$ - - of Oxide of Blue Vitriol.

The black flux to be calcined in an air furnace, then mixed with equal parts of manganese as above mentioned in receipt 132; when ground and used on the glass a most beautiful black will be eventually produced.

PROCESS 134.

To make an Enamel Indigo Blue for Painting on Glass.

Take 1 Part of Precipitate of Gold.

$4\frac{1}{2}$ - - of Flux. Process 72.

$\frac{1}{6}$ - - of White Enamel. Process 117.

These ingredients are simply ground together for use, and produce a beautiful colour on glass of a fine purple blue; this very expensive colour is adapted principally for the painting of the draperies of figures, but is very susceptible of being injured by a high degree of heat. On account of what has been stated respecting china enamels, renders it unnecessary that the observations on glass staining should be more copious and extensive.

PROCESS 135.

To make an Etching and Deadening Colour on Glass.

Take 7 Parts of Red Lead.

2 - - of Calcined Borax.

2 - - of Flint.

1 - - of Oxide of Tin.

PROCESS 136.

To make an Etching and Deadening Colour on Glass.

Take 8 Parts of Red Lead.
6 - - of Flint Glass.
3 - - of Flint.
½ - - of Green Copperas.

The materials of the last two processes must be finely mixed and calcined in an air furnace, each process separately, after which take 2 parts of No. 135, and 3 parts of No. 136 mix them together, and repeat the calcination again in an air furnace, then pound and grind this frit for use, but be particular that it is ground very fine, for much depends on the particles being minutely mixed previous to using; this composition is afterwards laid on the glass with water, and a small quantity of refined sugar dissolved in spring water applied occasionally; the solution or mucilage of sugar must be of the consistence of thick oil; should too large a quantity of the mucilage be added, and by that means condensate it too much, add a few drops of acetous acid to the menstruum, it will immediately regain a proper consistence, and not at all injure the colour: when the coating or deadening is laid on the glass, the figures, landscapes, &c. must be engraved or etched with a pointed instrument made of wood, bone, or ivory, suitable to the subject, and afterwards burned in a kiln or muffle appropriated for the purpose; it fires at a less temperature than stained glass, although

in some instances it will do in the same kiln, but the utmost care and attention is requisite when the sort of glass consists of drinking glasses, lest they should sink and fall down, which will most certainly be the case if the heat applied exceedsthe before-mentioned temperature; this colour being of a rich, white, silky appearance, is frequently introduced in the painting of window glass, and in many points of view is found a great acquisition.

For the use of those who are not practised in the art of Glass Painting and Staining, the following brief remarks, in further illustration of the subject, are subjoined :—The different colours for painting glass consist of glass of easy fusion, chiefly coloured with metallic calces, and the whole of these colours must be laid on the glass with spirits of turpentine. In the production and modification of these colours much depends on the different preparations of the metals, on the small proportion of the metallic calces employed in proportion to the vitrious mass, on the degree of fire and time of its continuance, and on the purity of each ingredient intended for vitrious mixtures; from hence in these operations difficulties may arise which even the most skilful operator cannot always remove, and which often frustrate his intention. Again, the first thing which ought to be done after having made choice of the subject to be painted, will be correctly to draw the same on a paper exactly the size intended to be on the glass, then

place the different pieces in regular order on the drawing and trace the outlines, &c. therefrom, as correctly as possible on the glass; when the tracing is quite dry the ground colours may be washed in together with the dark and prominent shades, also the stains as they are wanted and required; when they are dry the glass is ready to be burned in a muffle or kiln constructed for that purpose; the panes of glass are laid on sheets of iron or earthenware bats the size of the glass, but previously spread over with ground flint dried, to prevent the surface of the glass from being defaced; after the first burning nearly the whole of the colours and stains will want going over again, and in this manner the operator must proceed from 4 to 6 firings, the number of which depends on the subject and the degree of perfection required and the manner of execution; but let it be observed after each burning, the pieces of glass will want less labour, some of the colours and stains being perfect at the first and second burning; there are only few that require the utmost quantity, the proper degree of heat to which the glass must be exposed in the muffle is ascertained by taking out at different intervals small pieces of glass arranged for the purpose, on which are laid certain colours and stains, those are the best tests by which a proper judgment may be formed.

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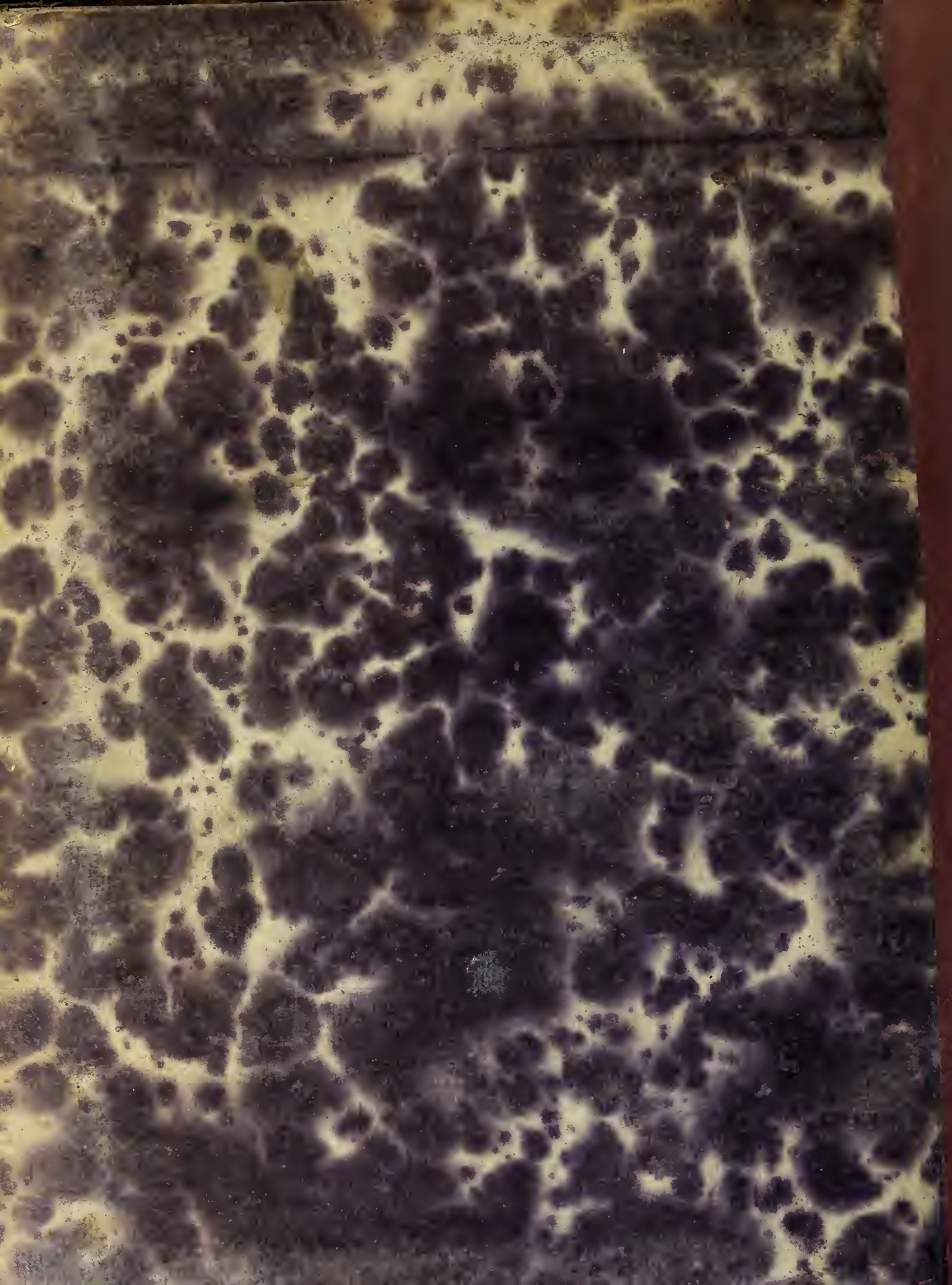
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